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Cost and Return Analysis of Tulsi Cultivation in East Champaran District of Bihar State

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ABSTRACT

Background: The study was undertaken in the East Champaran district of Bihar, where over one-third of the population is at risk of floods. To improve the socio-economic situation of tulsi farmers, the study analyzed the input profile, the link between cost and return and the impact of input cost on tulsi output and returns.

Methods: Under Aroma Mission, during 2024 CSIR-CIMAP demonstrated the tulsi cultivation in East Champaran Motihari district of Bihar on 32 beneficiaries from seven villages and adopts improved practices of tulsi cultivation towards higher yield. The study was predominantly based on primary data collected through field visit and through personal interview method from the all aroma mission beneficiary. To achieve the objectives of the study, the cost and returns for tulsi cultivation was worked out based on commission for agricultural costs and prices (CACP) cost concept and determine the input-output relationship as well as multiple regression analysis.

Result: The cost of cultivation is to be ` 35093/- for the tulsi crop. The gross income ` 106000/- per for three months. The farm business income, which considers initial costs (Cost A_1/A_2) is 82316/- per hectare. The farm Investment Income is ` 70907/- accounting for more comprehensive cost structures (Cost C_3). The benefit-cost ratio is observed to be highest (1:3.47) at Cost A_1 and the lowest benefit-cost ratio was observed at Cost C3 (1:2.02). The regression model explains 0.878 (88 per cent) of tulsi crop production variation, with human charges, seed cost and distillation charges showing significance. However, it is suggested that from this study tulsi cultivation model can be promoted in others part of the country, where problematic areas for improve their social and economic life changes.

Key words: Cost and returns, Essential oil, Sustainable growth.

INTRODUCTION

Tulsi (*Ocimum basilicum*) CIM-Soumya variety (*Kharif* season) has got the great medicinal value and essential oil and is also widely used in pharmaceuticals, perfumery, cosmetic industries, aroma therapy and herbal tea. Major chemical constituents are Methyl chevicol, linalool and citral (Aus Gyanya, 2024). The fresh leaves of tulsi are taken by the millions of people every day. The crop has vast potential for cultivation as a short duration economically viable aromatic crops that fits well with the existing cropping pattern The present study is the economics of production of tulsi aromatic crop. The plant has a lot of potential to be grown as an aromatic crop that can be grown for a short time and still make money. It also fits well with the way crops are usually grown (Ajjan *et al.,* 2009).

Tulsi cultivation in India is widespread, with major contributions from states like Uttar Pradesh, Madhya Pradesh, Bihar, Rajasthan, Gujarat, Andhra Pradesh, Telangana and Tamil Nadu. Uttar Pradesh is particularly known for large-scale Tulsi farming. Though the cultivation of tulsi is highly profitable and employment generation is in short duration and intercropping with some aromatic crops (Suresh *et al.,* 2012 and 2019). Essential oil of sweet basil is used for its flavour and fragrance, respectively, in the food and fragrance industries; it is also used in food products to increase shelf life (Balakrishnan *et al.,* 2018).

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The annual production of tulsi oil is significant, meeting both domestic and export demands. India's high-quality production of tulsi oil, extracted primarily from regions like Uttar Pradesh, Madhya Pradesh and Tamil Nadu, ensures its competitiveness in the global market.

MATERIALS AND METHODS

Under Aroma Mission, during 2024 CSIR-CIMAP demonstrated the tulsi cultivation in east champaran district of Bihar on 32 beneficiaries and adopts improved practices of tulsi cultivation towards higher yield, CSIR-CIMAP organized

number of training programme and provided the package of practices and seed of tulsi cultivation to each beneficiary. The study was predominantly based on primary data collected through field visit and through personal interview method from the beneficiary. To achieve the objectives of the study, the cost and returns for tulsi cultivation was worked out based on CACP cost concept and determine the input-output relationship as well as multiple regression analysis.

Cost concept

Cost A_1: All paid out expenses incurred in the tulsi cultivation + depreciation on fixed assets + Interest on working capital.
Cost A_2 is Cost A_1 + rent paid for leased-in land.
Cost B_1 is Cost A_2 + interest on value of owned fixed capital assets (excluding land).
Cost B_2 is Cost B_1 + rental value of owned land (minus land revenue).
Cost C_1 is Cost B_1 + imputed value of family labour.
Cost C_2 is Cost B_2 + imputed value of family labour.
Cost C_3 is Cost C_2 +10% of cost C_2

The net returns over these cost concepts have been calculated as the difference between the gross farm income (GI) and particular cost.
GI = value of main product (quantity × price)
Net return including family labour = GI - total cost including family labour
Net return excluding family labour = GI - total cost excluding family labour
Farm business income = GI - Cost A_2
Family level income = GI - Cost B_2
Net farm income = GI - Cost C_2
Farm investment income = GI - Cost C_3

The multiple linear production function was used to evaluate the resource use efficiency in the production of tulsi cultivation.

Multiple linear production function

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6$$

Where,
α = Intercept.
Y = Yield of tulsi oil (Kg/ha).
X_1 = Human charges (`/ha).
X_2 = Machine charges (Rs./ha).
X_3 = Seed cost (`/ha).
X_4 = Manure and Fertilizer charges (`/ha)
X_5 = Irrigation charges (`/ha)
X_6 = Distillation charges (`/ha)
β_1, β_2, β_3, β_4, β_5 and β_6 = Coefficient of dependent variable X_1.....X_n.

RESULTS AND DISCUSSION

Socio-economic profile of sample farmers and structure of costs and returns for the data analysis, various Examples of cost concepts include A_1, A_2, B_1, B_2, C_1, C_2 and C_3 were explored. The expenses of producing tulsi and the input: output relationship as well as multiple regression analysis.

Socio-economic profile

The socio-economic profile of tulsi farmers presented in Table 1 and reveals an average family size of 2.85 persons and a high literacy rate of 70.92%. The primary occupation for most farmers (72.37%) is agriculture, highlighting the importance of crop income and remaining (27.63%) working in allied sector. The sample reflects a diverse socio-economic mix, with OBC (48.65%) as the largest group, followed by General (36.73%) and SC/ST (14.62%). With an average landholding of 3.64 hectares, farmers dedicate most of their land (71.06%) to traditional crops like paddy (33.28), wheat (22.32). However, there's a growing interest in high-value medicinal and aromatic crops (MACs), which make up 28.94% of the total cultivated area. The most prevalent MACs are vetiver (14.44%) and mint (13.26%), followed by tulsi and lemongrass respectively.

Economics of tulsi cultivation

The cost structure of tulsi cultivation calculated at the current price prevailing in the market has been presented in the Table 2. Total cost of tulsi production is ` 35,093/- per hectare for three months, included human labor being the largest cost in ` 5864/ per hectare followed by distillation charge (` 3500/- per hectare), irrigation (` 2860/- per hectare), manure and fertilizers (` 2840/- per hecatre), machinery charge (` 2284/- per hectare), seed cost (` 2220/- per hectare), The total operating capital required per acre is 23684/- per hectare and Fixed capital costs, such as the rental value of land (Rs. 5,000/-) and interest on fixed capital (` 1,225/-) and managerial cost ` 3044/- respectively in the study area.

Table 1: Socio-economic profile of sampled farmers.

Parameter	Averages
Family size (No.)	2.85
Literacy status (%)	70.92
Occupation (%)	
Agriculture	72.37
Other (Dairy, Services, Fisheries, *etc.*)	27.63
Caste composition (%)	100
Gen	36.73
OBC	48.65
SC/ST	14.62
Land holding (ha)	3.64
Cropping pattern (%)	100
Traditional crops (%)	71.06
Paddy	33.28
Wheat	22.32
Maize	14.28
Potato	1.18
Medicinal and aromatic crops (%)	28.94
Tulsi	0.82
Vetivar	14.44
Mint	13.26
Lemongrass	0.42

Returns from tulsi cultivation

The cost and return per hectare from tulsi cultivation are presented in the Table 3. The gross income from the tulsi crop is ` 106,000/- per hectare, derived from an oil yield of 106 kg/hectare at a market price of ` 1,000 per kg. The farm business income, which considers initial costs (Cost A_1/ A_2), is ` 82316/- per hectare for three months. The net farm income is ` 74097/- per hectare reflecting the profit generated after subtracting the total expenses (Cost C_2). Additionally, the family level income remaining after covering basic costs (Cost B_2) is ` 79097/- indicating reasonable returns for family-managed farms and the Farm Investment Income is ` 70907/- accounting for more comprehensive cost structures (Cost C_3). The benefit -cost ratio over cost A_1 was to be highest (` 1:3.47) and $C_3$ was lowest (` 1:2.02) is respectively. Thus, the tulsi cultivation is considered to be profitable returns and financial feasible in selected area. It is better scope for unutilized of land diversified of the crop. This model replicate in another problematic and unreached area in various part of the country.

Estimated resources use efficiency of tulsi crop cultivation

The estimated resource use efficiency in tulsi production is presented in Table 4. The multiple determination of the regression coefficient (R^2) was estimated at 0.878, which indicates that 88% of the variation in tulsi yield was influenced by the explanatory variables in the model. The independent variables, such as human charges, cost of seeds and distillation charges, were found to have a positive and significant impact on tulsi oil returns in the study area. The coefficients of these variables imply that

Table 2: Cost structure of tulsi cultivation in Bihar. (`/ha)

Particulars	Amount (`)	%
Hired manpower charges	5864	16.71
Machine charges	2284	6.51
Seed cost	2220	6.33
Manures and fertilizers	2840	8.09
Irrigation	2840	8.09
Interculture	1836	5.23
Distillation charges	5000	14.25
Interest on working capital @7 per cent per annum	800	2.28
Cost A_1	23684	67.49
Rent paid in leased land	-	-
Cost A_2	23684	67.49
Interest on fixed cost capital @10 per cent	800	3.49
Cost B_1	24909	70.98
The rental value of own land	5000	14.25
Cost B_2	29909	85.23
Cost of family labour charges	1994	5.68
Cost C_1	26903	76.66
Cost of family labour charges	1994	5.68
Cost C_2	31903	90.01
Managerial cost @10% of cost C_2	3190	9.09
Cost C_3	35093	100.00

Table 3: Gross income, costs and net return over cost (` per hectare).

Particulars		Amount (`)	
Oil production (kg)		106	
Price rate (` per kg)		1000/-	
Gross income (`)		106000/-	
Cost concepts	Costs	Net return over the cost	B:C ratio
Cost A_1	23684	82316	1:3.47
Farm business income (Cost A_2)	23684	82316	1:3.47
Cost B_1	24909	81091	1:3.25
Cost B_2	29909	76091	1:2.54
Family level income (Cost C_1)	26903	79097	1:2.94
Net farm income (Cost C_2)	31903	74097	1:2.32
Farm investment income (Cost C_3)	35093	70907	1:2.02

Table 4: Estimated production factors for tulsi cultivation (N=32).

Parameters	Coefficients	Standard error	t Stat	P-value
Intercept (α)	84545.06	6791.52	0.446	0.340
Human charges (X_1)	1.887**	3.030	0.622	0.539
Machinery charges (X_2)	-7.6515	5.370	-1.424	0.166
Seed cost (X_3)	26.146**	14.376	-1.818	0.580
Manures and fertilizer (X_4)	10.905	5.633	1.936	0.064
Irrigation (X_5)	-1.3547	7.987	-0.169	0.866
Distillation charges (X_6)	4.277*	3.550	0.120	0.139
R^2	0.878			

* Significant at 1% (P<0.1) and ** significant at 5% (P<0.05) level of probability.

an increase in the cost of tulsi cultivation will lead to an increase in output, assuming all other variables remain constant.

CONCLUSION

Based on the study, agriculture and allied activities are the primary source of livelihood for farmers in the study areas. The farmers are quick to adopt new crops and technologies to improve their livelihoods. Therefore, cultivating tulsi is profitable for the selected farmers. The present study recommends that tulsi cultivation be promoted in the study area. Policy initiatives should encourage farming practices that ensure sustainable crop growth, improve the essential oil quality of tulsi and support small-scale farmers. This crop can be cultivated in other part of the country, particularly in problematic areas such as unutilized, rain-fed, animal-affected area, to improve the social and economic lives of farmers.

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Conflict of interest

All authors declared that there is no conflict of interest.

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